ON THE SPERMATOGENESIS OF THE EARWIG ANISOLABIS MARITIMA.[1]

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The material for the examination of the germ cells of *Anisolabis maritima* came from a colony of these earwigs at Bryn Mawr. On account of the interest in the behavior of the chromosomes in the germ cells of insects, it seems desirable to add this group to the list of those that have been investigated recently in this country.

The material was preserved in Flemming's stronger fluid or in Gilson's mercuro-nitric solution and stained by Heidenhain's iron-hæmatoxylin method or with thionin.

A preliminary paper on the spermatogenesis of *Forficula auricularia* by Zweiger, '06, which appeared in 1906, contains references to the bibliography of the subject.

In the youngest stages found at Bryn Mawr each cyst contained several spermatogonia. In these cells (Fig. 1) in the resting stage there is a large spherical body which stains like chromatin.

In the equatorial plate of the dividing spermatogonia seen in polar view there are twenty-four chromosomes and a plasmosome which stains faintly (Fig. 2).

In the telophase of the last spermatogonial division two chromosome rods become connected with the plasmosome and remain condensed throughout the growth stages of the first spermatocytes.

Synizesis and synapsis stages are shown in Figs. 3 and 4, and the spireme in Fig. 5. At some time during the growth stages of the spermatocyte the heterochromosome pair separate from the plasmosome, forming a single rounded mass which lies free in the nuclear space (Figs. 6 and 7).

The splitting of the chromosomes is shown in Fig. 8. In Fig. 9 chromosomes from the prophase of the first spermatocyte are

[1] For the identification of the species I am indebted to the kindness of Mr. J. A. G. Rehn, of the Academy of Natural Sciences, Philadelphia, Penna.

shown, together with the heterochromosome pair and the plasmosome. All are from the same cyst. Figs. 10, 11 and 12 are from late prophases of the first spermatocyte division. The chromosomes arrange themselves into two groups at opposite poles. This is shown in Fig. 10, where the black bodies represent one group and those in light outline are 180° away, while the one in heavy outline is approximately at the equator. Figs. 11 and 12 show a centrosome close to each group which had apparently moved with its centrosome to that position. That the final position of any chromosome at one or the other of the poles is due to the centrosome in whose sphere of influence it happens to lie is suggested by the fact that occasionally seven chromosomes are at one pole and only five at the other.

In the equatorial plate of the first spermatocyte division there are normally twelve chromosomes (Fig. 13). In two or three earwigs a few cells of a cyst show eleven, thirteen, sixteen or nineteen chromosomes in the equatorial plate of this division; but there are also present in these cysts tripolar or multipolar spindles which probably explain the irregularity. There are also occasionally giant nuclei with double the normal number of chromosomes. In one case of an abnormal spindle it is known that the material came from an earwig that had very recently moulted, and it is possible that there is a connection between the two facts (Riddle, '08). In one instance a tripolar spindle was observed also in a spermatogonial division.

In the anaphase of the first spermatocyte division the heterochromosome pair are late in dividing and lag behind the others (Figs. 15, 16, 17). They are about equal in size. They finally separate (Figs. 18, 19, 20), one going to each pole of the spindle, and pass into the prophase of the second spermatocyte division (Fig. 21). Here again the chromosomes show a tendency to arrange themselves at the poles. Fig. 22 shows the metaphase and Fig. 23 the equatorial plate of the second spermatocyte division with twelve chromosomes. Figs. 24 and 25 are from stages in the anaphase. The earliest stages of the spermatids are shown in Figs. 26, 27, 28 and 29, where the behavior of the archoplasm and the change in position of the centrosome can be seen. Fig. 32 shows the condensed chromatin body in

the young spermatozoa. The older spermatozoa arrange themselves in bundles by inserting their heads into a cyst cell.

The material which is to form the spindle fibers is conspicuous at an early stage and is very considerable in amount. It forms another layer of fibers around the spindle proper (Figs. 5, 21, 22).

Something like the "mitosoma" described for *Forficula* by Zweiger, '06, is present in *Anisolabis* (Fig. 1), although the form is apparently unlike in the two species. It is traceable possibly from the spermatogonium to the spermatid; but as it does not stain with thionin after an early stage, and as it is very small and there are many granules in the iron-hæmatoxylin preparation, it is not by any means certain that the structures observed are one and the same throughout the series (Fig. 20).

The somatic chromosome number, found in the cells of the egg follicle, is twenty-four (Fig. 30). The material was not favorable for the examination of the ova. Very few were found in division stages and only one was cut so that its chromosomes could be counted. In this only equatorial plate observed the number of the chromosomes is twenty-four.

The characteristic structure of the male germ cells of *Anisolabis maritima* is an equal heterochromosome pair which are present possibly in the spermatogonia although they are not distinguishable from the other chromosomes in the spermatogonial divisions. In any case, it is formed anew in the telophase of the last spermatogonial division. It remains condensed during the growth stages of the first spermatocyte and divides equally in the first spermatocyte division, lagging behind the other chromosomes in the anaphase. It is not evident in the second spermatocyte division but there is a condensed chromatin body in the spermatids. This equal heterochromosome pair appears to be like the equal pair of idiochromosomes found by Wilson, '05, in *Nezara* and the equal heterochromosome pair of Stevens, '06, in Lepidoptera.

BRYN MAWR COLLEGE,
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Explanation of Plate I.

All figures were drawn with Zeiss camera lucida, 2 mm. oil immersion objective, 12 ocular, enlarged 2 diameters with a drawing camera and reduced the same.

Fig. 1. Spermatogonium, resting stage. *m* (?), the "mitosoma" of Zweiger.

Fig. 2. Spermatogonium, equatorial plate. *p*, the plasmosome.

Fig. 3. First spermatocyte, synizesis stage. *hc*, the heterochromosome.

Fig. 4. First spermatocyte, synapsis stage.

Fig. 5. First spermatocyte, spireme stage.

Fig. 6. First spermatocyte, the heterochromosome pair partially separated from the plasmosome.

Fig. 7. First spermatocyte, the heterochromosome pair separated from the plasmosome.

Fig. 8. First spermatocyte, the chromosomes partially split.

Fig. 9. First spermatocyte, prophase; the forms of the chromosomes, all from the same cyst.

Fig. 10. First spermatocyte, prophase; the six chromosomes in solid black are at one pole and the five in outline at the opposite pole; the one in heavy outline is at the equator.

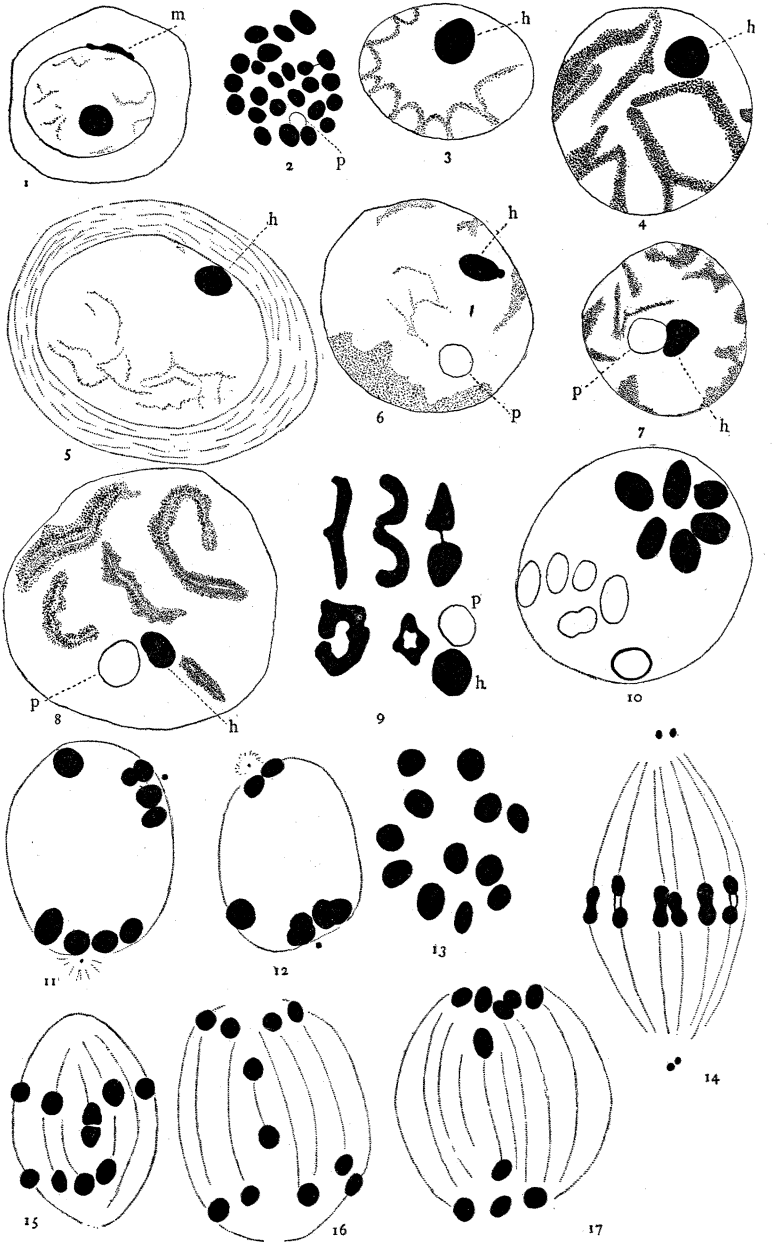
Figs. 11 and 12. First spermatocyte, prophase; the chromosomes on the way to opposite poles under the influence of the centrosomes.

Fig. 13. First spermatocyte, equatorial plate.

Fig. 14. First spermatocyte, metaphase.

Fig. 15. First spermatocyte, early anaphase.

Figs. 16 and 17. Later anaphase stages.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Explanation of Plate II.

Figs. 18 and 19. Late anaphase stages.

Fig. 20. Telophase; *?m*, the "mitosoma" of Zweiger.

Fig. 21. Second spermatocyte, prophase.

Fig. 22. Second spermatocyte, metaphase.

Fig. 23. Second spermatocyte, equatorial plate.

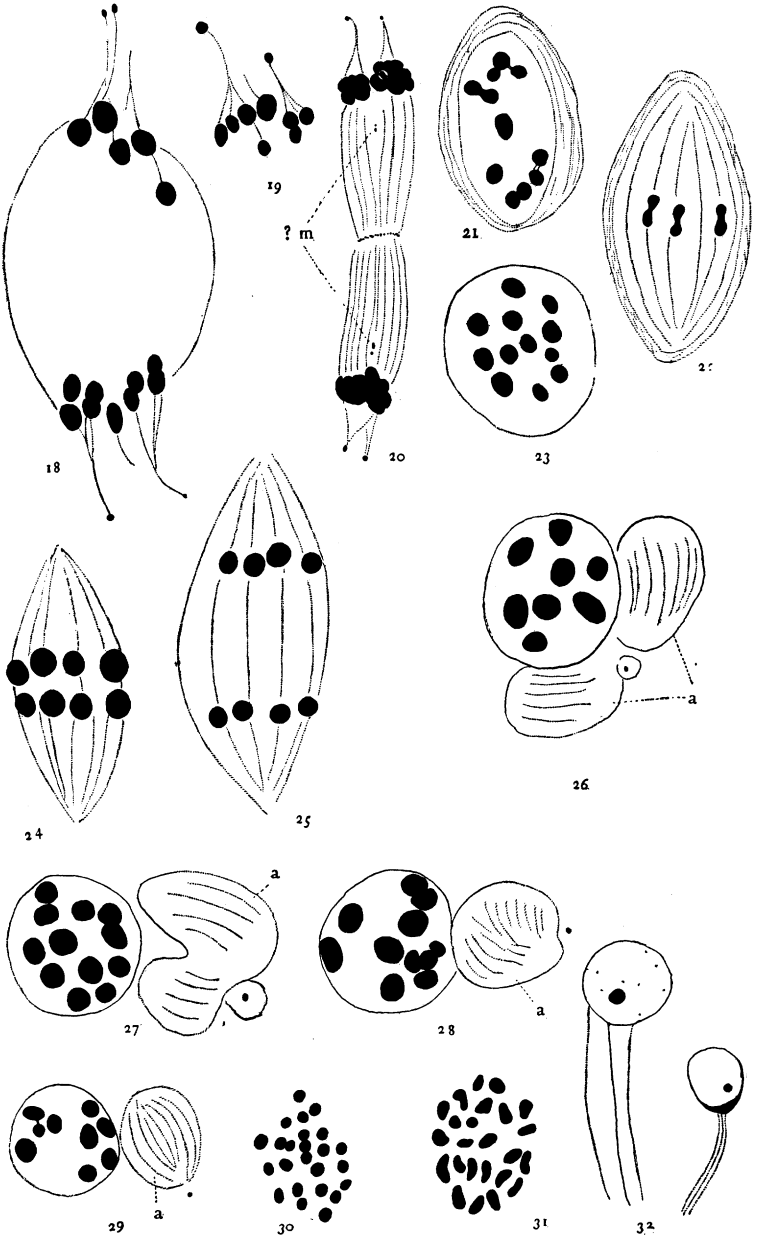
Figs. 24 and 25. Second spermatocyte, anaphase stages.

Figs. 26, 27, 28, 29. Spermatids, showing archoplasma (*a*) in different stages, and the movement of the centrosome.

Fig. 30. Somatic cell of female, equatorial plate.

Fig. 31. Ovum, equatorial plate.

Fig. 32. Young spermatozoa containing condensed chromatin.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